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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/733,243	12/07/2000	Robert Louis Hodges	98-P-104C1 (850063.542C1)	7298

30423 7590 07/03/2002
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EXAMINER

TRINH, MICHAEL MANH

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 07/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n No.

09/733,243

Applicant(s)

HODGES, ROBERT LOUIS

Examiner

Michael M Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 May 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

*** This office action is in response to Applicant's election and amendment filed on May 30, 2002. Claims 1-13 were canceled. Claims 14-25 are pending.

Election/Restrictions

1. Applicant's election filed May 30, 2002 without traverse of method claims 14-25 in Paper No. 5 is **acknowledged**. Claim 11 is withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected.

*** Non-elected Claim 11 was also cancelled by Applicant.

Claim Rejections - 35 USC § 112

2. Claims 14-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re base claims 14 and 21: Using different terms to recite the same layer render meaning and scope of the claims, if not new matter, being unclear and indefinite. For example of the inconsistency: a) Claim 14 recites "forming an opening [a recess]...and extending through said first layer..." while claim 21 differently recites "forming a recess...and not through said first layer..." and while specification Fig 1 recites "opening through the third layer..."; and b) Claim 14 recites "forming a second layer in the gap..." while claim 21 differently recites "forming a fourth layer in the gap...", etc.

(Dependent claims are rejected as depending on rejected base claim.

3. Claim 25 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

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Nowhere in the original specification teach the step of “removing any portions remaining of the second layer is performed prior to forming a fourth layer in the gap” as recited in Claim 25 which depends on base claim 21.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

5. Claims 14,17,20,21,22,23 are rejected under 35 U.S.C. 102(e) as being anticipated by Kao et al (5,688,700).

Re claim 14, Kao teaches a method (at figs 1-16; cols 4-5) for forming feature having a critical selected dimension comprising at least the steps of: forming a first layer 22 (Fig 7) having a first thickness; forming an opening 24 having vertical sidewalls separated by a width greater than the critical dimension 25 extending through the first layer 22; forming a blanket dielectric layer 28 (Fig 8; col 4, lines 50-60) having a second thickness in the opening, on the first layer and on the sidewalls, the second thickness being half or less of the first thickness; selectively and anisotropically etching the blanket dielectric layer to form dielectric spacers 30 (Fig 9; col 4, lines 61+) on the sidewalls and to remove the blanket dielectric layer from a bottom of the opening without etching the first layer, the dielectric spacers 30 separated by a gap having a width equal to the critical dimension; forming a second layer 36 (Fig 13) in the gap and on the first layer; removing those portions of the second layer formed on the first layer using a chemical-mechanical polish without removing portions of the second layer in the gaps (Fig 14; col 5, lines 26-41); and removing the first layer 22 but not the dielectric spacers 30 (Figs 15-16).

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Re claim 21, Kao teaches forming a first layer 20 (Fig 7) having a first thickness on a semiconductor substrate 12; forming a second layer 22 over the first layer 20, the second layer having a second thickness thicker than the first layer and being etchable by a different etch chemistry than the first layer 20; forming a recess opening 24 having vertical sidewalls separated by a width greater than the critical selected dimension 25 extending through the second layer 22 and not through the first layer 20 (Fig 7); forming a blanket dielectric layer 28 (Fig 8; col 4, lines 50-60) having a third thickness in the opening, on the second layer 22 and on the sidewalls, and on top of the first layer in the recess opening, the third thickness being half or less of the second thickness; selectively and anisotropically etching the blanket dielectric layer to form dielectric spacers 30 (Fig 9; col 4, lines 61+) on the sidewalls and to remove the blanket dielectric layer from a bottom of the recess opening; etching the first layer 20 to expose the substrate (Figs 10-11) and form a gap having a width equal to the critical selected dimension between the dielectric spacers 30; forming a fourth layer 36 (Fig 13) in the gap and on the substrate (Fig 14; col 5, lines 26-41); and removing any remaining portions of the second layer 22 without removing the dielectric spacers 30 (Figs 15-16).

Re claim 17, wherein the blanket dielectric layer 28 is silicon nitride (col 4, lines 55-60).

Re claim 19, wherein the second layer of polysilicon (col 5, lines 26-34).

Re claims 22-23, wherein forming the first layer having a first thickness comprises forming two chemically distinct sub-layers and selectively etchable on the surface of the substrate, wherein forming the first layer comprises forming a thermal oxide 14 on the substrate of silicon; and forming a silicon nitride layer 20 having a thickness of less than five hundred Angstroms on the thermal oxide 14.

6. Claims 14,17,22,24,25 are rejected under 35 U.S.C. 102(b) as being anticipated by Kao et al (5,688,700).

Goth et al teach (at figs 5A-5B; cols 7-8) a method for forming feature having a critical selected dimension comprising at least the steps forming a first layer 52 (Fig 5A) having a first thickness on a semiconductor substrate; forming a second layer 53/54 over the first layer 52, the second layer having a second thickness thicker than the first layer and being etchable by a different etch chemistry than the first layer 52; forming a recess opening having vertical

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sidewalls separated by a width greater than the critical selected dimension extending through the second layer 53/54 and not through the first layer 52 (Fig 5A); forming a blanket dielectric layer 55 (Fig 5B; col 7, lines 20-40) having a third thickness in the opening, on the second layer 53/54 and on the sidewalls, and on top of the first layer 52 in the recess opening, the third thickness being half or less of the second thickness; selectively and anisotropically etching the blanket dielectric layer to form dielectric spacers 56 (Fig 5C; col 7) on the sidewalls and to remove the blanket dielectric layer from a bottom of the recess opening; etching the first layer 52 to expose the substrate (Fig 5D) and form a gap having a width equal to the critical selected dimension between the dielectric spacers 56; forming a fourth layer 57 (Fig 5E) in the gap and on the substrate (Fig 5E; col 7, line 5 to col 8); and removing any remaining portions of the second layer 22 without removing the dielectric spacers (Figs 5C-5D).

Re claim 17, wherein the blanket dielectric layer 55 is silicon nitride (col 7, lines 32-40).

Re claim 22, wherein forming the first layer having a first thickness comprises forming two chemically distinct sub-layers and selectively etchable on the surface of the substrate wherein the first layer comprises a thermal oxide 78 on the substrate of silicon and a silicon nitride layer 79 on the thermal oxide 78 (Fig 7A; col 9, lines 60-68).

Re claim 24, wherein the second layer 53 having a thickness including 5000 Angstroms (col 10, lines 20-25).

Re claim 25, wherein remaining of the second layer 53/54 (Figs 5C-5D) is removed before forming a fourth layer 57 in the gap (Fig 5E).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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8. Claims 15,16, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kao et al (5,688,700) taken with Niwa (5,597,752) or Chau et al (5,434,093).

Kao teaches a method (at figs 1-16; cols 4-5) for forming feature having a critical selected dimension as applied above to claims 14,17,20,21,22,23. Re further claims 15,16,14, Kao also teaches to form a series of chemically distinct sub-layers and selectively etchable on the surface of the substrate, wherein forming the first layer comprises forming a thermal oxide 14 on the substrate of silicon; forming a silicon nitride layer 20 having a thickness of less than five hundred Angstroms on the thermal oxide 14; and forming a silicon oxide layer 22 having a thickness on the silicon nitride layer. Re claim 19, Kao also teaches to pre-cleaning by stripping the pad oxide 14; forming gate oxide layer 34 on the substrate within the gap (col 5, lines 19-25); forming a channel within the gap (figs 10-16); forming the second layer 36 of conductive material (fig 13), and chemical-mechanical polishing to remove the second layer from the first layer 22 (col 5, lines 26-54).

Re claims 15,16,24, Kao teaches to form the silicon oxide top layer, but lacks to mention a thickness of five thousand Angstroms or less.

Niwa teaches (at col 5, lines 51-15) to form the silicon oxide top layer 4 having a thickness of about 5000 Angstroms. Chau et al teach (at col 7, lines 25-67) to select the insulating layer 201 of silicon nitride or oxide (col 7, lines 64-68) having a thickness within the range of approximately 0.05 to 1 microns (500-10000 Angstroms), wherein 2000-4000 Angstroms is mentioned at col 7, lines 23-35.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the silicon oxide top layer of Kao by selecting the portion of the prior art's thickness range, as taught by Niwa and Chau, which is within the range of applicant's claims because it has been held to be obvious to select a value in a known range by optimization for the best results, see *In re Aller, et al.*, 105 USPQ 233.

Re claim 19, Kao forms the gate oxide top layer, but lacks to mention thermally growing.

However, Niwa teaches (at col 6, lines 15-28; Figs 4E-4F) to pre-cleaning by etching the oxide layer 2 and then thermally growing a new gate silicon oxide layer 7. Chau et al teach (at

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Figs 2e-2f; col 10, lines 16-41) to cleaning the substrate and thermally growing a gate oxide 212 in the gap.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the gate oxide of Kao by pre-cleaning and thermally growing a new gate oxide in the gap as taught by Niwa and Chau. This is because of the desirability to selectively forming a high quality gate oxide in the gap.

9. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kao et al (5,688,700) taken with Wolf et al (Page 192, second paragraph).

Kao teaches a method (at figs 1-16; cols 4-5) for forming feature having a critical selected dimension as applied above to claims 14,17,20,21,22,23.

Re claim 18, Kao teaches to form the blanket dielectric layer of the silicon nitride, but lacks to mention using LPCVD.

However, Wolf teaches (at page 192,) to use LPCVD for depositing the silicon nitride.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit the silicon nitride layer of Kao by using LPCVD as taught by Wolf et al for reasons of film uniformity and lower processing cost.

10. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kao et al (5,688,700) taken with Goth et al (4,58,528).

Kao teaches a method (at figs 1-16; cols 4-5) for forming feature having a critical selected dimension as applied above to claims 14,17,20,21,22,23.

Re claim 25, Kao lacks to remove remaining second layer prior to forming fourth layer.

However, Goth teaches (at figs 5A-5B; cols 7-8) to remove remaining second layer 53/54 (Figs 5C-5D) prior to forming a fourth layer 57 in the gap (Fig 5E)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Kao by remove any remaining second layer prior to form a fourth layer in the gap as taught by Goth et al for reasons of forming a plurality electrode layer at the same time and thus reducing processing time.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (703) 308-2554. The examiner can normally be reached on M-F from 8:30 Am to 4:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Whitehead Jr Carl can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.
Oacs



Michael Trinh
Primary Examiner